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Operations, Planning, and Command and Control

SATELLITE DISPOSAL PROCEDURES

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This SI establishes United States Strategic Command (USSTRATCOM) policy on the disposal of Department of Defense (DoD) owned satellites which Commander, USSTRATCOM (CDRUSSTRATCOM) exercises Combatant Command (COCOM) authority as defined by the current Forces for Unified Commands document. It applies to all USSTRATCOM components and subordinate organizations operating satellite systems under CDRUSSTRATCOM COCOM authority (currently consisting of operational, DoD-owned communications, navigation, missile warning, and environmental monitoring assets). It does not apply to satellite systems CDRUSSTRATCOM does not exercise COCOM authority over, such as those systems operated by the National Reconnaissance Office (NRO) or Research and Development (R&D) systems. A glossary of references and supporting information is at **Attachment 1**.

1. General. The space environment is a critical medium for collecting and disseminating information crucial to accomplishing warfighter's missions. Retaining partially mission capable (PMC) or non-mission capable (NMC) spacecraft in high-value, operational orbits creates risk of collision between abandoned and operational satellites. Furthermore, such collisions can become a secondary source of orbital debris posing a threat to future space operations that is difficult to control. This SI's procedures comply with the minimization and mitigation of space debris as directed by National and DoD space policy (PDD NSC-49/NSTC-8, DODD 3100.10, and the U.S. Government Orbital Debris Mitigation Standards and Practices). These guidelines do not preclude any end-of-life testing that organizations with satellite system responsibility deem necessary either prior to or after placing the satellite into a disposal orbit. Satellite operators must ensure testing does not endanger capability to remove satellites from operational orbit.

2. Responsibilities. CDRUSSTRATCOM exercises COCOM over the subordinate organizations controlling DoD-owned satellites as shown in **Table 1.** and **Table 2.,** with Commander, Joint Functional Component Command, Space and Global Strike (CDR JFCC-SGS) exercising operational control (OPCON) over these organizations for space operations. Additionally, the Commander, Joint Space Operations (CDR JSO) exercises tactical control (TACON) over these organizations as required to control

the designated forces (bus management). For Military Satellite Communications (MILSATCOM) systems owned by DoD, CDRUSSTRATCOM has delegated Satellite Communications (SATCOM) Operational Manager (SOM) responsibilities to the USSTRATCOM SATCOM Operations Division (J66).

Table 1. Organizations With System Responsibility (Military Communication Satellites and Secondary Payloads).

SATELLITE SYSTEMS/PAYLOADS	SATCOM OPERATIONAL MANAGER (SOM)	SATCOM SYSTEM EXPERT (SSE)
FLTSAT, UHF Follow-On (UFO), UFO EHF (UFO E), Polar EHF	USSTRATCOM/J66	NAVNETWARCOM
WGS, GBS	USSTRATCOM/J66	SMDC/ARSTRAT
DSCS	USSTRATCOM/J66	DISA
Milstar, AFSATCOM, Polar UHF, LES, AEHF	USSTRATCOM/J66	AFSTRAT (AFSPC – SSE)

Table 2. Organizations With System Responsibility (Non-Communication Satellites).

SATELLITE SYSTEMS	ORGANIZATION
DSP, GPS, SBIRS	AFSTRAT
DMSP, NPOESS/GOES/POESS	AFSTRAT in coordination with the National Polar-Orbiting Operational Environment Satellite System (NPOESS) Integrated Program Office (IPO)
Geodetic/Geo-Physical Satellite Follow-on (GFO)	Navy Space and Naval Warfare Systems/Command Intelligence, Surveillance, Reconnaissance, and Information Operations Program Office (SPAWAR PMW 180)

3. Mission Payload/Vehicle Health. Removing an NMC satellite from its operational orbit and placing it into an established disposal region is of paramount importance. Throughout a satellite's life, each SATCOM System Expert (SSE) responsible for the satellite in support of the SOM, or their equivalent for non-SATCOM systems (see **Tables 1 and 2**), will ensure every SSE-designated satellite maintains adequate disposal capability in accordance with (IAW) SD 714-2. This includes assuring command/control capability and maintaining the required amount of fuel to reach the disposal region. The SSE, or equivalent for non-SATCOM systems, will recommend disposal if any degradation would preclude future removal from high-value operational orbits.

3.1. **Adjunct Payloads.** For systems residing as payloads on host satellites not controlled by CDRUSSTRATCOM, the satellite controlling authority will conduct satellite disposal. Any mission payload controlled by CDRUSSTRATCOM will undergo end-of-life procedures for the specific mission as determined by the SSE (or equivalent), and include coordination with the host satellite controlling authority.

3.2. **Booster Stages.** Consistent with National and DoD space policy on mitigation of orbital debris, when possible, rocket components (including upper stages, payload assist modules, and apogee boost systems) must not remain within operational satellite orbits (co-orbital). Additionally, the booster

orbit's perigee and/or apogee must not be within an operational orbit. Once the stage has completed its mission, it will enter an orbit leading to atmospheric reentry or enter one of the orbital disposal regions listed in paragraphs 7.1. - 7.6.

4. Disposal Criteria. SSEs, or their equivalent for non-SATCOM systems, will coordinate with satellite operations and sustainment activities, as well as with components or agencies with secondary payloads on the bus, to develop specific criteria for satellite disposal (see **Table 3**). Criteria should include but are not limited to: the minimum acceptable levels of bus support to the payloads, payload (primary and secondary) capability and capacity, contribution of payload to overall constellation performance, vehicle command/control capability, vehicle power capacity, fuel required for disposal maneuver, and any other disposal maneuver requirements. USSTRATCOM components and agencies will forward the criteria to the appropriate USSTRATCOM directorate for review and approval within 60 days of vehicle COCOM acceptance. Disposal criteria for existing on-orbit systems will be submitted within 60 days of the publication date of this SI. Major criteria for disposal actions include:

Table 3. Disposal Criteria.

Satellite SystemS	Disposal Action	Criteria
SATCOM DSCS, UFO, FLTSAT, Milstar, WGS, Polar UHF, LES, AEHF	Plan of Action, to include: Orbit, fuel, TACO requirements/requests/approval End-Of-Life Requirements (if any) Disposal Date Coordination with JTF-GNO and other appropriate agencies of primary and secondary payloads	USSTRATCOM must have: COCOM TACO Complete Disposal Date Coordination with/Notification of appropriate agencies
Non-SATCOM DSP, DMSP, SBIRS, and GPS	Plan of Action, to include: Orbit, fuel, TACO requirements/requests/approval End-Of-Life Requirements (if any) Disposal Date Coordination with appropriate agencies of primary and secondary payloads	USSTRATCOM must have: COCOM TACO Complete Disposal Date Coordination with/Notification of appropriate agencies

4.1. **Payload/Bus Problem.** The satellite has a non-recoverable bus or payload problem rendering it PMC or NMC. PMC systems will be measured against the specific disposal criteria established by the SSEs (see **Table 3**), or their equivalent for non-SATCOM systems. For NMC satellites, SSEs or their equivalents for non-SATCOM systems will forward disposal recommendation to USSTRATCOM immediately.

4.2. **Inadequate Performance.** Payload or bus degradation makes the satellite unable to sustain adequate performance, especially degradation that negatively impacts the entire constellation and users.

4.3. **Disposal Capability.** The satellite is not expected to have a minimum safe disposal capability.

4.4. **Improved Capability Available.** SSEs, or their equivalent for non-SATCOM systems, can recommend disposal of a Fully-Mission Capable (FMC) or PMC satellite if they need to remove it to make room for a new satellite with advanced capabilities. USSTRATCOM will evaluate the recommendation and determine the final satellite disposition.

4.5. De-apportionment/“Mothballing”/On-orbit Storage. On-orbit storage of PMC systems is not considered normal constellation management and must be approved by USSTRATCOM Director, Global Operations (J3). The operational value of retaining a PMC vehicle in an operational orbital location must be fully justified and contrasted with the risk associated with keeping the vehicle on station. The PMC satellite must retain the capability to remove it from the operational orbit when it is time to dispose of it.

4.6. Test and Check-out (TACO). If the SSE or equivalent plans to put a satellite into an extended TACO orbit after it has reached end-of-life, they must first move the satellite into its disposal orbit (with the exception of Global Positioning System (GPS)). USSTRATCOM will then relinquish COCOM of the satellite and turn it over to the operators (i.e., the Satellite Control Authority (SCA)) who will conduct the TACO. Satellite operators/SCAs will take every measure to ensure testing does not endanger capability to save the satellite.

5. Standard Operations. SSEs, or their equivalent for non-SATCOM systems, will monitor satellite capability criteria as part of standard operations. Once they designate a satellite as NMC and/or the satellite has potential disposal capability problems per the established criteria, the organization will forward a disposal recommendation to USSTRATCOM. SSE's, specifically, will coordinate with the Joint Task Force, Global Network Operations (JTF-GNO) Global SATCOM Support Center (GSSC) prior to forwarding to USSTRATCOM. At a minimum, the recommendation will include the disposal criteria the satellite meets and projected date of disposal. When possible, SSEs, or their equivalent for non-SATCOM systems should send standard disposal recommendations 120 days in advance of the anticipated disposal date. If USSTRATCOM no longer holds COCOM of a satellite (e.g., satellites in long-term TACO programs), the SSE or equivalent may approve disposal (with GSSC concurrence for SSE submissions), with info message to USSTRATCOM stating disposal timeline and planned final disposition.

5.1. SATCOM Disposal Recommendation. SATCOM SSEs will provide disposal recommendations to the Consolidated SSEs (C-SSE) who will then coordinate throughout the community of interest and provide recommendations to USSTRATCOM/J66. USSTRATCOM/J66 and the Joint Space Operations Center (JSpOC) will produce a coordinated communications capability and space vehicle risk assessment to recommend disposal to USSTRATCOM/J3 and Deputy Commander, JFCC-SGS (DCDR JFCC-SGS). This recommendation will include a plan of action and timeline for disposal/transfer to include end-of-life testing requirements, transition of all affected communications requirements, TACO, and disposal orbit parameters. Upon USSTRATCOM/J3 and DCDR JFCC-SGS concurrence, the recommendation will be forwarded to CDRUSSTRATCOM. Upon CDRUSSTRATCOM approval, the disposal order will be sent to CDR JFCC-SGS (via the JSpOC) for execution and to the Chairman, Joint Chiefs of Staff (CJCS) for information.

5.2. Non-MILSATCOM Disposal Recommendation. The organization with satellite system responsibility will submit its disposal recommendation to include a plan of action and disposal timeline to USSTRATCOM/J3 and DCDR JFCC-SGS. This should also include any end-of-life testing requirements, TACO, and disposal orbit parameters. Upon USSTRATCOM/J3 and DCDR JFCC-SGS concurrence, the recommendation will be forwarded to CDRUSSTRATCOM. Upon CDRUSSTRATCOM approval, the disposal order will be sent to CDR JFCC-SGS for execution and to CJCS for information.

5.3. **Maneuver Vector Screening.** Before disposal, the component will ensure the system operator submits planned disposal vectors and orbit parameters to Cheyenne Mountain Operations Center (CMOC) Space Control Division (CMOC/J3S) and to the JSpOC-Mountain (JSpOC-Mtn) (1st Space Control Squadron/Mission Generation Flight (1SPCS/MAO)), through CDR JFCC-SGS, for reentry location approval and/or orbital safety screening for possible conflicts. CDR JFCC-SGS will resolve any conflicts. After completing disposal maneuvers, the component will ensure the system operator provides the final vectors to CMOC. If the satellite fails to reach proper disposal orbit, the Space Control Center (SCC) will conduct conjunction analysis. If there is a possible conflict with a manned space vehicle or other objects, the SCC will continue routine conjunction analysis and notify the JSpOC and other space partners of all conjunctions associated with disposal operations.

6. Emergency Operations. Emergency operations for satellite disposal occur when a satellite bus component that is needed to command the satellite is operating on the redundant component and begins to operate abnormally, and the SSE or equivalent for non-SATCOM systems believes there is less than 30 days to safely dispose of the satellite. Under these conditions, the system operator, after receiving technical concurrence from the SSE or equivalent for non-SATCOM systems will make an expedited disposal request via telephone to the JSpOC with official notification to follow via a Space Information Message (SIM).

6.1. For SATCOM systems, the SOM and SSE will develop, coordinate and maintain contingency communications transition plans for all space vehicles that are PMC or operating on a redundant bus component, or operating on any system whose failure would preclude normal satellite disposal timelines.

6.2. The JSpOC will develop, coordinate, and maintain an emergency disposal plan for all space vehicles operating on a redundant bus component, or operating on any system whose failure would preclude normal satellite disposal timelines.

7. Post-Mission Disposal. A satellite/booster/upper stage post-mission disposal plan should use a maneuver strategy that most reduces the risk of leaving it in or near a high-value orbit. Where possible, disposal orbits will be targeted to minimize long-term eccentricity growth that would result in incursions into operational orbit regions. If a satellite/booster/upper stage cannot be moved to a disposal orbit, operators must take all actions to ensure the vehicle is safed and in a position to present the least risk to operational satellites. The system operator will dispose of the satellite/booster/upper stage by placing in one of the following orbits:

7.1. **Atmospheric Reentry.** Maneuver the satellite/booster/upper stage to an orbit in which, using conservative projections for solar activity and other perturbations, atmospheric drag will cause atmospheric reentry within 25 years after completing the mission (IAW DODI 3100.12). For immediate reentry, the system operator will plan the reentry so any remaining portions of the satellite will impact the earth only in non-populated, preferably oceanic, areas.

7.2. **Between Low Earth Orbit (LEO) and Medium Earth Orbit (MEO)/Semi-synchronous.** Maneuver the satellite/booster/upper stage to an orbit with perigee altitude above 2,000 kilometers (km) and apogee altitude below 18,400 km.

7.3. Between MEO/Semi-synchronous and Geosynchronous Earth Orbit (GEO). Maneuver the satellite/booster/upper stage to an orbit that has either perigee altitude above 20,700 km and apogee altitude below 22,000 km, or perigee altitude above 25,200 km and apogee altitude below 34,800 km. These regions are designated in order to avoid the operational altitudes of GPS (~20,183 km), Global Navigation Satellite System (GLONASS) (~19,100 km), and Galileo (~23,222 km).

7.4. Above GEO. Maneuver the satellite/booster/upper stage to an orbit with perigee altitude above 36,100 km.

7.5. Heliocentric, Earth-escape. Maneuver to remove the satellite/booster/upper stage from Earth orbit, into a heliocentric orbit. USSTRATCOM/J3 will coordinate with National Aeronautics and Space Administration (NASA) to deconflict the planned disposal orbit with NASA's heliocentric probes.

7.6. Direct retrieval. Retrieve the satellite/booster/upper stage and remove it from orbit as soon as practical after mission completion.

8. Vehicle Safing. The SSE or equivalent (for non-SATCOM systems) must ensure the payload and bus are safed as a critical step in the disposal process. This procedure will eliminate stored energy from the satellite/booster/upper stage and limit the probability of a post-mission explosion spreading debris. Safing procedures vary with each system, but may include burning all residual fuel to depletion and leaving fuel line valves open; disabling all battery charging systems; leaving batteries in a permanent discharge state; venting all pressurized systems; removing power from control gyroscopes; disabling transmitters; deactivating range safety systems; depleting all volatile liquids; and/or stabilizing the spacecraft in a neutral thermal flight mode. The SSE or equivalent for non-SATCOM systems will determine which of the above procedures are best to safe their satellite/booster/upper stage upon disposal.

9. Review. Recommended changes to this SI may be raised to USSTRATCOM at any time as necessary. As a minimum, USSTRATCOM and its components will review this SI at least every 3 years to ensure it provides the most current guidance.

DARREN W. JOHNSON, Major, USAF
Command Secretariat

Attachment 1**GLOSSARY OF REFERENCES AND SUPPORTING INFORMATION*****References***

CJCSI 6250.01B, *Satellite Communications*, 28 May 2004
DODD 3100.10, *Space Policy*, 9 July 1999
DODI 3100.12, *Space Support*, 14 September 2000
Forces for Unified Commands document, 24 November 2004
PDD NSC-49/NSTC-8, *National Space Policy*, 14 September 1996
SD 714-2, *Satellite Communication (SATCOM) System Expert (SSE) Responsibilities*, 20 September 2005
U.S. Government Orbital Debris Mitigation Standards and Practices, December 2000

Abbreviations and Acronyms

AEHF—Advanced Extremely High Frequency
AFSATCOM—Air Force Satellite Communications
AFSPC—Air Force Space Command
AFSTRAT—Air Forces Strategic Command
CDR JFCC-SGS—Commander, Joint Functional Component Command, Space and Global Strike
CDRUSSTRATCOM—Commander, United States Strategic Command
CJCS—Chairman, Joint Chiefs of Staff
COCOM—Combatant Command
DCDR JFCC-SGS—Deputy Commander, JFCC-SGS
DISA—Defense Information Systems Agency
DMSP—Defense Meteorological Support Program
DoD—Department of Defense
DSCS—Defense Satellite Communications System
DSP—Defense Support Program
EHF—Extremely High Frequency
FCC—Federal Communications Commission
FLTSAT—Fleet Satellite Communications System
GBS—Global Broadcast Service
GEO—Geosynchronous Earth Orbit

GOES—Geostationary Operational Environmental Satellite

GPS—Global Positioning System

IAW—In Accordance With

JSpOC—Joint Space Operations Center

JTF-GNO—Joint Task Force, Global Network Operations

km—kilometers

LES—Lincoln Experimental Satellite

MEO—Medium Earth Orbit

MILSATCOM—Military Satellite Communications

Milstar—Military Strategic and Tactical Relay

NAVNETWARCOM—Naval Network Warfare Command

NMC—Non-Mission Capable

NPOESS—National Polar-Orbiting Operational Environment Satellite System

NROI—National Reconnaissance Office Instruction

OPCON—Operational Control

PDD—Presidential Decision Directive

PMC—Partially Mission Capable

POESS—Polar Operational Satellite System

SATCOM—Satellite Communications

SBIRS—Space-Based Infrared System

SI—Strategic Command Instruction

SMDC/ARSTRAT—Space and Missile Defense Command/Army Strategic Command

SOM—SATCOM Operational Manager

SSE—SATCOM System Expert

TACO—Test And Check-Out

TACON—Tactical Control

UFO—UHF Follow-On

UFO E—UHF Follow-On EHF

UHF—Ultra-High Frequency

UPD—United States Space Command Policy Directive

USSTRATCOM—United States Strategic Command

USSTRATCOM/J3—Director, Global Operations

USSTRATCOM/J66—SATCOM Operations Division**WGS—Wideband Gapfiller Satellite*****Terms***

Apogee—The point of a satellite's greatest distance from Earth and minimum velocity.

Bus—The part of the satellite that carries and supports the payload. The bus includes the satellite's structure, power system, telemetry, tracking and commanding system, attitude control system, and thermal control. The satellite bus can degrade/fail before the payload, making disposal necessary even though the payload can still accomplish the mission.

Combatant Command (COCOM)—Non-transferable command authority established by Title 10, United States Code, Section 164, exercised only by commanders of unified combatant commands. COCOM is the authority of a Combatant Commander to perform those functions of command over assigned forces involving organizing and employing commands and forces, assigning tasks, designating objectives, and giving authoritative direction over all aspects of military operations, joint training, and logistics necessary to accomplish the mission assigned to the command. COCOM provides full authority to organize and employ commands and forces as the Combatant Commander considers necessary to accomplish assigned missions.

Components—The four service components of USSTRATCOM are United States Army Strategic Command (USARSTRAT), NAVNETWARCOM, Air Force Space Command (AFSPC), and Marine Forces Strategic Command (MARFORSTRAT). NAVNETWARCOM delegates day-to-day space operations to Naval Network and Space Operations Command (NNSOC).

Consolidated SATCOM System Expert (C-SSE)—The CDRUSSTRATCOM has designated C-SSEs for Wideband, Narrowband, Protected, and Commercial to coordinate and integrate community of interest and cross-system inputs for associated system SSEs. C-SSEs, with the support of the system SSEs, provide an integrated SATCOM management framework supporting SOM efforts to deconflict, assess, analyze, and integrate SATCOM information, status, configurations, synchronization, sustainment issues, deployment issues, and anomalies. C-SSEs are: Wideband—SMDC/ARSTRAT; Narrowband—Commander of the Naval Network War Command (CNNWC); Protected—AFSPC; Commercial—DISA.

End-of-Life—When a satellite is no longer useful. This occurs when the satellite's payload or bus becomes so degraded it can no longer support operations, or when the payload's users no longer need it to accomplish their mission. It is possible for another agency to use a satellite's residual capability after the vehicle reaches end-of-life. However, this is not authorized if bus degradations would prevent proper satellite disposal.

Geosynchronous—An orbit with a period of approximately 24 hours. A geostationary orbit is a geosynchronous orbit over the equator, making the satellite appear to stay over one point on the earth's surface.

Heliocentric—An orbit with the sun at its focus. A heliocentric satellite orbits the sun instead of the earth.

Military Satellite Communications (MILSATCOM)—The satellite communications resources that DoD owns and operates primarily in the government frequency bands. CDRUSSTRATCOM COCOM systems include, but are not limited to, Defense Satellite Communications System (DSCS), Fleet Satellite (FLTSAT), UHF Follow-on (UFO), Military Strategic and Tactical Relay (Milstar), EHF Polar, and Wideband Gapfiller System (WGS).

Non-MILSATCOM—The non-MILSATCOM systems that DoD owns and operates primarily in the government frequency bands. CDRUSSTRATCOM COCOM systems include, but are not limited to, Global Positioning Satellite (GPS), Defense Satellite Program (DSP), and Defense Meteorological Satellite Program (DMSP).

Payload—The components performing the satellite's mission (for example, communications, navigation, weather, warning). A satellite can carry more than one payload, expanding its primary mission or giving it secondary missions.

Perigee—The point of a satellite's closest approach to Earth and maximum velocity.

Safing—Operators configure a satellite's payload and bus to prevent it from inadvertently changing orbits or breaking up, presenting danger to operational satellites.

SATCOM—Satellite Communications. For this SI, DoD-owned and leased satellite communications systems for which SSEs and SOMs are responsible.

SATCOM System Expert (SSE)—The component or designated organization responsible for providing technical planning and functions to support the operational management of a specific SATCOM constellation.

Satellite Control Authority (SCA)—The authority to provide Telemetry, Tracking and Commanding (TT&C) of the satellite's bus and to provide control and management of the satellite's payload. Analogous to TACON, SCA is inherent in the OPCON of a satellite. The COCOM authority can delegate OPCON and/or SCA, in part or entirely, to another organization.

SATCOM Operational Manager (SOM)—Directs day-to-day operational management of DoD-owned and leased SATCOM resources and additional duties as defined in CJCSI 6250.01B.

Secondary Payloads—Those payloads on a satellite providing a capability different from its primary payload. Authorities must consider a satellite system's secondary capability when deciding to dispose of a satellite.

Semi-synchronous—An orbit with a period of approximately 12 hours.